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ELECTRIC POWER AND POWER EQUIPMENT

UZBEK INSTITUTE DEVELOPS SOLAR-POWERED STIRLING ENGINE

Tashkent PRAVDA VOSTOKA in Russian 14 Nov 79 p 4

[Author: Ye. Yefimov, correspondent]

[Abstract] The article is a report on the work of the Uzbek Academy of Sciences' Physical-Technical Institute on various types of Stirling engines. For example, a model of a starter motor for large industrial tractors has been built, and there is a conceptual design of a micro-Stirling to drive an artificial heart. The Uzbek academy has published a "Calculation of parameters of an internal heat-exchange contour for Stirling engines." This work on Stirling engines is being done by researchers in the department of heliophysics. Identified are Giyas Yakubovich Umarov, corresponding member of the Uzbek academy, and his students and associates--Vasiliy Stepanovich Trukhov, Il'dar Abdullayevich Tursunbayev and Yuriy Yefimovich Klyuchevskiy. Their main interest is solar power.

It is noted that Tashkent physicists hold one of only four patents that have been issued for basic modifications of the Stirling engine since it was invented. At the institute's solar equipment test facility, he witnessed the initial startup of a solar model that is said to represent a new family of Stirling engines. Sunlight is focused on the machine by a reflector fastened behind it. In a matter of minutes its small piston moved, and the wheels began to turn, running on air alternately heated by the sun and cooled by water. The model's capacity is 10 watts.

Regarding the possibility of using these engines to produce electricity, it is noted that the institute has a concept of a solar electric power plant of the new future: dozens of reflectors on a desert plateau, and next to each reflector--a Stirling engine and a generator with a capacity on the order of 10 kilowatts. It is reported that there is a working model of a solar-power unit with a Stirling engine on a collective farm of Yangiyul' Rayon.

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FIRST INDUSTRIAL MHD POWER-GENERATING UNIT DESCRIBED

Moscow PRAVDA in Russian 1 Oct 79 p 1

[Article by R. Kuznetsova]

[Abstract] The article reports that construction has begun on the first industrial magnetohydrodynamic power-generating unit in Ryazan'. The unit consists of a 250-megawatt MHD generator and a standard steam turbine. Its rated capacity will be 500 megawatts. It is scheduled to begin operation in 1985. The plans for the MHD power station are being drawn up by the "Energiya" Research and Production Association of the USSR Ministry of Power Engineering and Electrification.

USSR Minister of Power Engineering and Electrification Petr Stepanovich Neporozhniy answered questions about the MHD power station in an interview. He pointed out that the first generation of such stations will have an efficiency factor of 50 percent, and the second generation will have a 60-percent efficiency factor. The amount of fuel they burn is expected to be 20-30 percent less than that burned by conventional thermal power stations, and the amount of water used will be only half. Neporozhniy noted that in principle it is possible to achieve an output of 1000 megawatts in a single MHD unit.

Neporozhniy acknowledged the experience gained from operation of the U-02 and U-25 experimental MHD power units at the USSR Academy of Sciences' Institute of High Temperatures, thanks to which many scientific and engineering problems were solved. Research is continuing on the U-25 unit, which has now operated for more than 10,000 hours.

Neporozhniy also commented on the environmental advantages of MHD power generation.

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FUELS AND RELATED EQUIPMENT

DEVELOPMENT OF WESTERN SIBERIA'S OIL AND GAS REVIEWED

Moscow OBSHCHESTVENNYYE NAUKI in Russian No 6, Nov-Dec 79 pp 80-89

[Article by Anatoliy Alekseyev, Valeriy Kuleshov, Yuriy Maksimov, and Nina Plyaskina: "Development of the Oil and Gas Resources of Western Siberia"]

> [Text] A.M. Alekseyev is a doctor of economic sciences, head of the division for optimum planning of sectors of indudtry of the Institute of Economics and Organization of Industrial Production (IEiOPP) of the Siberian Department of the USSR Academy of Sciences, and the author of works on multi-level models of optimization of complex economic systems.
>
> V.V. Kuleshov is a candidate of economic sciences, head of the sector of optimization of the development of raw material sectors of industry of the IEiOPP of the Siberian Department of the USSR Academy of Sciences, and the author of works on using statistical methods in optimum sectorial planning.
>
> Yu. Maksimov is a doctor of technical sciences, head of the sector of development and distribution of the oil and gas and the petrochemical industry of the IEiOPP, Siberian Department, USSR Academy of Sciences, and the author of works on problems of simulation of the development of sectors of the fuel and power complex.
>
> N.I. Plyaskina is a senior engineer in the laboratory of research in mathematical economics of Novosibirsk State University, and the author of works on long-range planning of gas industry facilities.

The energy system created in the USSR occupies second place in the world after the United States with respect to its potential (with rates of growth outstripping the United States). In addition, our country holds first place in the world with respect to the extraction of oil and coal, the scales of concentration and centralization of production of electric power, and the development of central heating systems.

Development of the Fuel and Power Complex of the USSR[1]

Type of Fuel and Power Resource	1965	1970	1975	1976	1977
Gas (billion cubic meters)	128	198	289	321	346
Oil (million tons)	243	353	491	520	546
Coal (million tons)	578	624	701	712	722
Electric power (billion kilowatt-hours)	507	741	1039	1111	1150

In the 10th Five-Year Plan (1976-1980) the fuel and power complex of the USSR has entered a qualitatively new stage of its development. This is determined, on the one hand, by the features of economic growth, by the complexity and scales of the socioeconomic problems to be solved by the USSR in accordance with the economic strategy developed by the 25th CPSU Congress, and on the other hand by the essential changes in the conditions of supplying power for the national economy in the future. A very important task in connection with this is the preservation of high rates of development of the fuel and power complex, which would insure growth in the production, processing and transportation of power resources in the necessary amounts.

One of the basic conditions necessary for solution of this task is the presence of an adequate raw material base. Huge reserves of oil and gas in the industrial categories make it possible to improve the structure of fuel extraction. In 1980 in the primary fuel and power resources the proportion of oil and natural gas will be 67.6 percent, and that of coal (with an increase in the absolute volumes of extraction) will be 26 percent. In 1975 these indicators were, respectively, 64.2 and 30.9 percent.[2]

Western Siberia occupies a special place in insuring the increases in the extraction of oil and natural gas. The attenuation of oil extraction in the Northern Caucasus and the Ukraine, in the Volga region and Azerbaijan, and the stabilization of extraction owing to intensification in Tataria, Bashkiria and in Kuybyshevskaya Oblast have demanded accelerated development of the deposits of Western Siberia, of the Komi and Udmurt ASSR's, of Perm' and the Mangyshlak peninsula.

An analogous situation is taking shape regarding the extraction of gas. Development of the gas industry at accelerated rates became possible thanks to providing a corresponding increase in the reserves of industrial categories of natural gas. An evaluation of these reserves, concentrated in different gas-extraction regions, shows that the chief source of an increase in gas extraction for the country in the near future is the gas and gas-condensate deposits of Western Siberia. The bulk of them--very large unique deposits--is located in the northern regions of Tyumenskaya Oblast.

Proportion of Eastern Regions of the USSR in Extraction of Basic Fuel and Power Resources (in percents)[3]

Type of Fuel and Power Resources	1970	1975	1980
Oil	18.1	39.0	55.0
Gas	29.8	47.5	63.8
Coal	43.1	49.2	53.8

It is possible arbitrarily to consider 1965 as the start of industrial development of these deposits, when 3.2 million cubic meters of gas was extracted. In 1970 gas extraction came to 9.3 billion cubic meters (4.7 percent of the unionwide level), and in 1975 it rose to 35.7 billion cubic meters (12.3 percent of the unionwide level). The goal planned for 1980 is 155 billion cubic meters, which comes to more than 35 percent of the unionwide level.[4]

The natural gas reserves in Tyumen' deposits will make it possible to bring the extraction up to 500-600 billion cubic meters per year. With these reserves the level of extraction of 500 billion cubic meters, attained by 1990, could be maintained until 2018, and a level of extraction of 600 billion cubic meters, attained by 1990, could be maintained up to 2012.

The scope of the reserves of industrial categories of Siberian oil is shown best of all by the headlong rates of the growth in its extraction. While in 1970 8.9 percent of the union's extraction of oil (31.4 million tons) fell to the share of Western Siberia, in 1975 this share came to 30 percent (148 million tons).[5] In 1980 it is planned to produce 315 million tons of Siberian oil, which should comprise more than half of the unionwide extraction.

With this it is necessary to note that while the growth in oil extraction during the 10th Five-Year Plan for the USSR as a whole has been planned at the volume of 129-149 million tons, for the Tyumen' complex this increase should come to 152-162 million tons.[6] Thus, the Tyumen' complex should not only provide the whole increase in extraction of oil for the country, but it should also compensate the withdrawal of a number of oil extracting regions.

The main directions of development of Siberia's fuel and power complex and reorganization of its structure in the future up to 1990 are:

Further growth in the extraction, flexibility of supply and utilization of natural gas. The natural gas of Western Siberia can serve as an effective substitute for oil in many directions;

Augmented development of hydroengineering construction;

Stabilization of the increase in oil extraction in the 12th Five-Year Plan (1986-1990) with insuring a significant intensification of oil refining (up to 60 percent and more);

A substantial increase in the role of coal fuel owing to creation of the Kansk-Achinsk Fuel and Power Complex (KATEK; Kansko-Achinskiy Toplivnoenergeticheskiy Kompleks), which will have the leading role in development of Siberia's coal industry. In addition there should be a substantial increase in the extraction of coal in the Kuznetsk Basin in order to increase the resources of relatively cheap and transportable fuel.

Development of the resources of Siberia's fuel and power complex and particularly of the Western Siberian oil and gas province and KATEK is a complex problem of unionwide significance, which can be solved effectively only on the level of a national program. Acceleration of the development of these resources calls forth the necessity of solving the following basic problems:

Fully meeting Siberia's demands for fuel and power with a substantial rise in the quality structure of fuel supply;

Providing reserves for intensification of the process of locating energy-intensive industries of different sectors of the national economy in Siberia;

Allocating the maximum amount of energy resources of Siberia for reducing the strain on the fuel and power balance of regions of the European part of the USSR and the Urals;

Providing export supplies of fuel and power resources.

The following composition of the end product of the Western Siberian territorial-production complex (TPK) was determined by decisions of the 25th CPSU Congress: oil, gas, synthetic rubber, plastics. In accordance with this it is possible to determine a preliminary list of sectors making up the Western Siberian territorial-production complex: oil and petrochemical, gas and gas refining, construction, geological prospecting, electric power engineering, transport. All the sectors named (applicable to the given region) can be put in the category of newly established ones. Continuing to be developed is the timber and woodworking industry, a traditional one for the Western Siberian TPK, and the oldest sector in the region, which even less than 10 years ago determined its specialization to a considerable degree.

Such a center of the oil industry as Surgut has today become the focus of electric power engineering, the timber and woodworking industry, home building, river, railroad, air and motor vehicle transport and so on. In another city of oilmen, in Nizhnevartovsk based on the Samotlor oil deposit, a mighty industry has been created for using casing-head gas. The dried gas is partially used by aggregates of the Surgutskaya GRES. The other part of the dried gas is supplied to the Kuzhetsk Basin along a trunk line that has been laid.

The liquid products of gas processing--the unstable gasoline--are sent to petrochemical plants of the Urals, the Central Volga, Tataria and so on, first on a product pipeline, then by railroad. The given product of processing casing-head gas is becoming the main raw material of the Tobol'sk petrochemical complex which is under construction.

Such cities as Surgut, Nizhnevartovsk, and also Nefteyugansk and Nadym, have one other unique load. They are the rear bases for further development of the natural resources of the Central Ob' region and the attack on the north of Tyumenskaya Oblast.

The continuous increase in the extraction of oil, condensate and gas (for instance in 1979 it is proposed to increase oil extraction by 29.3 million tons and gas extraction by 33 billion cubic meters) requires corresponding development of the network of transport communications for transferring the extracted raw material and fuel to the industrial centers. Today the length of the trunk pipelines of the Tyumen' region exceeds 15,000 kilometers and will increase in a year by approximately 2,000 kilometers.

All this is the result of embodiment of the plans for realization of the first stage in formation of the Western Siberian territorial-production complex. Along with this a retrospective analysis of the development of the productive forces of the given region shows that a number of elements of incompleteness has been observed in the development of the forming sectors of very different character. For instance, certain difficulties arise due to the absence of adequate synchronism in the creation of such a chain of interconnected production facilities as the extraction of oil to the utilization of casing head gas at gas processing plants to the utilization of the liquid products of gas processing in petrochemistry. The times for construction of the Tobol'sk Petrochemical Complex were not fully coordinated with the start-up of the capacities of the gas-processing plants in Nizhnevartovsk. As a result, difficulties arose at the latter regarding disposal of one of the products of gas processing--the unstable gasoline.

The incompleteness when setting up facilities of the infrastructure and the systematic lag in their construction hinder the development of the Western Siberian Territorial-Production Complex. Thus, an analysis of the dynamics of introduction of fixed capital for the Tyumengazprom Association during 1973-1975 shows that a considerable part of the money during development of the gas deposits, especially in the first years, was put into basic production facilities. A regular lack of fulfillment of the volumes of operations for construction of material and technical supply centers was observed.[7]

The deciding factor in successful realization of the program of the Western Siberian TPK are the people, who from the first days of development of this territory have been models of selfless, creative labor. In the past five years the population of Tyumenskaya Oblast has increased by 300,000 people. The number of residents of Surgut and Nizhnevartovsk has reached the 100,000-mark.

Despite the growth in labor productivity, the continuously increasing scales of production and construction demand the attraction of additional labor resources. A specific source of covering the shortage of specialized labor is the use of the expedition-watch method: the enlistment of drilling brigades from other regions of the country (for instance, from Tataria, Bashkiria and so on), but this does not solve the problem of providing the territory with labor resources. Standing in the forefront is the question of formation of the complex's own cadres in as short a time as possible. Necessary for this is the solution of many socioeconomic tasks connected, for instance, with the training of cadres, regulation of movement of manpower between sectors, creation of a ramified social infrastructure, and so on.[8]

It is obvious that when planning the development of such a complex organism as the Western Siberian TPK it is required to consider economic, social, demographic, geographic and other factors. Therefore from this viewpoint the only expedient way is the program-target approach to problems of the Western Siberian Territorial Production Complex.

Capacities in the northern part of Western Siberia are being developed at rapid rates at present. Characteristic features of these regions are a low level of development (lacking a developed production and social-domestic infractructure), remoteness from industrial centers and year-round communication routes. In connection with this the problem of complex long-range planning of development takes on the greatest urgency here.

One of the solutions to this problem is the creation of a long-term program of economic development of the region which will be a vast complex of measures for the construction and putting into operation of railroads and highways, and of servicing industries, and for setting up and development of deposits. The most important condition which should be guaranteed during realization of the program is consideration of the interconnections between the construction of objects of the infrastructure and starting the development of deposits. The effect of objects of the infrastructure on individual deposits is manifested not so much in the assignment of deadlines for beginning their development, as in the unification of all projects in a single economic mechanism, which will make it possible to realize the idea of complex planning of the gas-extracting region.

It should be noted that the model intended to describe the program of development of the gas-extracting region should be as universal and dynamic as possible. This is connected with the complexity and the dynamic nature of the considered object of planning and with the necessity of interconnecting models of different hierarchic levels. Static models cannot adequately describe the process of planning, insofar as the annual volumes of extraction, the outlays corresponding to them and the recovery of gas from the region as a whole are changed in the process of exploitation.

The model of assimilation and development of the gas-extracting region should reflect the basic time and resource relationships, and also the technologically predetermined sequence of fulfillment of the steps of the program. The advantages that critical-path models have make it possible to use them for long-range planning of the assimilation and development of the gas-extracting region.

At the given stage of research we constructed a network schedule of assimilation and development of the gas-extracting region of the north of Tyumenskaya Oblast, containing 116 jobs and 99 events. According to its content the model is a network diagram, uniting the network models of seven deposits, denoted among themselves by the jobs for creation of the infrastructure projects of rayon-wide significance, and also by ficticious ties reflecting the time dependencies (duration of dummy jobs, zero) of fulfillment of the steps of the program. The basic link in the model of development of the gas-extracting region is the network model of the deposit. The overall picture of development of the region will, in essence, depend on how the actual process of development of the gas deposit is answered by its network model. Therefore the main demand regarding construction of the diagram which will be the model of development of the deposit is the reflection in it of the most essential jobs, from the positions of the long-term perspective.

All seven deposits reflected in a consolidated schedule of the region are identical, since they are in identical natural and climatic conditions and have, in essence, equal geological and field characteristics. In connection with this, raised for all deposits are the problems of creating a production and social-domestic infrastructure of local significance, and also implementing the industrial development of it.

The proposed critical-path model of assimilation and development of the deposit is a consolidated, universal one. The model is a consolidated one since reflected in it are only the basic objects of assimilation and the stages of development of the deposit. The universal nature of the model consists, firstly, in that it is a two-product model: both gas and condensate are reflected in it. Secondly, considered in the model are all possible periods of development of the deposit. Thirdly, the model makes it possible to consider the inhabitance of the region by introducing in it the projects of the first and second phases of housing construction. Fourthly, several versions of fulfillment of each job are provided, which are distinguished according to type of resource consumed, the volume and intensity of its consumption, and the duration and deadlines for fulfillment.

The adopted production version of development of the region, characterized by the deadlines for putting the deposits into operation and the versions of development of each deposit, is regarded as the directive section of the network model of the region.

Determined when implementing the latter is that time of starting construction of the objects of the infrastructure when their introduction could be carried out in synchronization with the development of the deposit. In this case the volumes of critical resources to be expended will not exceed the limits assigned to the given region, and the time for fulfillment of the program is minimal.

The proposed imitation model of the program of assimilation and development of deposits of the region makes it possible to consider several versions (alternatives) of fulfillment of the program, distinguished by the make-up of the objects and the sequence of their creation (the topology of the network is changed), by the time description of the measures (the initial year of assimilation of the region, the directive deadlines for introduction of objects, the duration of construction of the projects), and by the dynamics of the capital investments and the specifics of their distribution.

Selected for the calculations of the stated task was quite effective software[9] which will make it possible to obtain for each version a feasible schedule of all the jobs and events described in the model, and the outlays attributed to the start of the year which correspond to it. Economic analysis of the many versions checked will make it possible to rank the obtained decisions according to the adduced outlays and to select the best versions.

Thus, combining an accurate mathematical algorithm with expert analysis yields a good solution of the problem, which would have been impossible with direct application of purely formal means.

At the present time multi-version calculations have been made according to the proposed approach to long-range planning of the gas-extracting region. We have made retrospective calculations under the assumption that set-up of the gas-extracting region of the north of Tyumenskaya Oblast has not begun. Several versions of development of the region were considered with different times for the start of its assimilation. Taken as the initial year of assimilation of the region were 1965, 1966, 1968, and 1970.

An analysis of the time relations, made on the basis of calculations according to the network model of assimilation and development of the gas-extracting region, showed that entry of the deposits into industrial development is completely predetermined by the construction of objects of the infrastructure of region-wide and local significance. Playing an important role for the region is the construction of the Surgut-Urengoy railroad, since its introduction predetermines the operation of the region's transport system, including the highways, and also the start of opening up the deposits. Consequently, acceleration of the development of the region's natural resources depends on the rates of construction of corresponding sections of the Surgut-Urengoy railroad and other objects of the infrastructure.

Calculations according to the network model make it possible to obtain a schedule of erection of objects of the infrastructure which will make it possible to carry out their introduction synchronized with the assigned directive deadlines for bringing the region's deposits into industrial development. In this case the overall length of development of the region will be minimal.

The resource description of the optimum version has independent interest. Schedules of assimilation of capital investments in a dynamic scheme with realization of the program were obtained with the aid of automated calculations.

We did not consider construction of trunk gas pipelines in the region in connection with the fact that this is an independent large problem. The given type of construction does not pertain to the infractructure of the region, but is a basic production facility along with the extraction of gas, therefore subsequently implied under capital investments for assimilation and development of the region's deposits is the total volume of capital investments allocated for development of the Tyumenskaya Oblast gas industry minus that sum which is directed for the construction of trunk gas pipelines.

During the calculations taken as the initial limitations for capital investments were the amounts used in the region in the 9th Five-Year Plan (1971-1975), allocated by USSR Gosplan for the 10th Five-Year Plan (1976-1980) and proposed by USSR Gosplan for the 11th (1981-1985) and 12th (1986-1990) five-year plans.

Considered were the different versions distinguished by the volumes and dynamics of the capital investments used in the 8th Five-Year Plan (1966-1970). This assumption is explained by that the model utilized, differing from the actual facts, assumes first of all the construction of the Surgut-Urengoy railroad, which makes it possible to carry out constant supply of the deposits to be assimilated with the necessary materials. The first version assumes that allocated for the 7th Five-Year Plan was a volume of capital investments equal to the volume of the 9th Five-Year Plan. The second version assumes that the capital investments for the 8th Five-Year Plan were reduced two-fold, and the third assumes they were increased approximately two-fold by comparison with the 9th Five-Year Plan.

The multi-variant calculations made showed that according to the optimum version of development of the Tyumen' gas-extracting region for fulfillment of the developed complex program it is necessary to allocate almost

20 billion rubles of capital investments, 47.5 percent of which must be aimed directly at extraction of gas, and 52.5 percent at setting up the region, including 14.2 percent of the total volume of capital investments for creating the social infrastructure, 11.7 percent for the general regional production infrastructure, and 26.6 percent for the production infrastructure at the deposits.

Complex development of production and the infrastructure in the gas-extracting region will insure a saving of up to 26 percent of the capital investments by comparison with construction of individual enterprises. With interconnected construction of the railroad and oil field facilities the transport outlays are reduced 2-2.5-fold, and as a result the cost of construction is reduced by 20 percent and the time it takes is also reduced.

Consequently, from the position of a complex approach to development of newly assimilated regions it is necessary first of all to create objects of the infrastructure, which will make it possible to avoid the disproportions which inevitably arise in connection with the absence of transport support.

The described versions of assimilation and development of the deposits of the gas-extracting region of the northern Tyumenskaya Oblast can serve as an example of the use of the proposed approach to complex long-range planning of the gas-extracting region.

FOOTNOTES

1. See "SSSR v tsifrakh v 1977 godu" [USSR in Figures in 1977], Moscow, 1978, pp 102-103.

2. See "Energetika SSSR v 1976-1980 godakh" [USSR Power Engineering in 1976-1980], Moscow, 1977, p 146.

3. See Ibid., p. 148.

4. See: N.D. Varyukhina, V.Ya. Gandkin, V.R. Serna, "Osnovnyye ekonomicheskiye pokazateli gazodobyvayushchey promyshlennosti SSSR za 1960-1975 gg." [Basic Economic Indicators of the USSR Gas Extracting Industry for 1960-1975], Moscow, 1977, p. 12; Ya. Mazover, "Distribution of the Fuel-Extracting Industry, PLANOVOYE KHOZYAYSTVO, 1977, No. 11, p. 145.

5. See Ya. Mazover, op. cit., p. 138.

6. See G.P. Bogomyakov, "The Tyumen' Complex and its Future," EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA (EKO), 1976, No. 3, p. 8.

7. See: A.P. Tret'yekova, T.I. Bogopol'skaya, "Formation of the Production Base in Gas-Extracting Regions of Tyumenskaya Oblast," EKONOMIKA, ORGANIZATSIYA I UPRAVLENIYE V GAZOVOY PROMYSHLENNOSTI, Moscow, 1976, No. 5.

8. Many of these problems were discussed by scientists and specialists in June 1978 in Tyumen' during a "round-table" meeting on the subject of "Basic Problems of Complex Development of Western Siberia" (see, for instance, VOPROSY FILOSOFII, 1978, Nos. 9, 11).

9. The algorithms and software were developed in the Institute of Mathematics of the Siberian Department of the USSR Academy of Sciences under the leadership of E. Gimadi.

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FUELS AND RELATED EQUIPMENT

KAZAKH SHELF PETROLEUM, GAS DEPOSITS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 11 Nov 79 p 2

/Article by Doctor of Economic Sciences and Honored Figure of Science of the Kazakh SSR E. Turkebayev, director of the Scientific Research Economics Institute of Planning and Standards attached to Kazakh SSR State Planning Committee, and Candidate of Geological and Mineralogical Sciences S. Shalabayev, chief of the Department of Problems of the Development of Mineral Resources and the Use of Nature: "The Reserves of the Kazakh Shelf"/

/Text/ The world practice of exploration and geological prospecting does not confine itself to the discovery of petroleum and gas deposits on dry land, but is developing the search for new underground stores under the continental and sea shelves on a greater and greater scale. In our country the deposits of hydrocarbon raw materials, which are located deep under the bottom of the Caspian, have been worked for many years now. In Azerbaijan the offshore fields yield more than 60 percent of the petroleum and 90 percent of the natural gas. Many complicated technical problems of building offshore oil fields have been successfully solved here. Exploratory drilling is being carried out from floating rigs and stationary platforms.

However, sites in the Caspian Shelf, which are promising for petroleum and gas, exist not only along the coast of Azerbaijan. Studies of recent years make it possible also to assign to them the extensive underwater territory from Karabogaz to Prorva along the shores of Kazakhstan.

The Southern Mangyshlak Depression, in the northern section of which such well-known deposits as Uzen' and Zhetybay were discovered and are being worked, merits particular attention. Its southern and southwestern edges in their geological structure are similar to the northern section and reach far out under the bottom of the Caspian Sea. Sites promising for exploratory drilling have already been readied here.

The analysis of the geological and geophysical materials shows that it is possible to anticipate the discovery of new underwater deposits on the northern slope of the Karabogaz Anticline and in a number of offshore sections located near the Mangyshlak Peninsula. Recently a commercial flow of petroleum was obtained from the Kalamkas-25 littoral well. It revealed several productive beds which continue under the sea bottom.

In short, the regions of the Kazakh Shelf, where there is a real possibility to prepare considerable reserves of petroleum and gas for commercial recovery, are well known. The Ministry of the Petroleum Industry began exploration and prospecting here several years ago. But they were carried out in an extremely small amount. Only three wells were drilled at the Aralda Sea site, and on the Zapadnoye Rakushechnoye structure it was not possible to reach promising horizons. The situation has not improved even now, when the solution of this problem has been assigned to the Kaspmorneftegaz Association of the Ministry of the Gas Industry.

What is the matter here? Is it that the promising sites are inconvenient for development and their prospecting is inadvisable, from the economic point of view? A simple comparison shows that this is not so. Along the coast of Azerbaijan the depth of the water is from 30 to 60 m and more, while the productive horizons occur at depths of 4,500-5,500 m. Within the Kazakh Shelf the picture is different: the depth of the sea here does not exceed 0.5-25 m, while the promising beds are located at a depth of 750 to 4,000 m. Moreover, in this sector of the Caspian there are almost no storms, and the geological conditions make it possible to carry out well drilling at stepped-up schedules.

Preliminary estimates show that two factors alone--the lower cost of offshore construction in shallow water and the comparatively shallow occurrence of the productive horizons--will make it possible to save on each drilled well on the order of 500,000-600,000 rubles. And there will be several hundred such wells on each structural site.

Another circumstance must be taken into account. In the regions being spoken about, in the immediate vicinity of the shore petroleum and gas pipelines have already been laid and centers of population have been built. Thus, excessively great capital investments will not be required for the organization of the commercial recovery of fuel. This is another serious argument in favor of the great effectiveness of their prospecting and development.

Why are exploration and prospecting being developed so slowly? On the territory of the republic the subdivisions of the Kazakh SSR Ministry of Geology and the Mangyshlakneft' and Embaneft' associations of the Ministry of the Petroleum Industry are carrying them out. The forces seem to be considerable. However, all these organizations are exploring for underground stores only on dry land. They are completely unsuited for activity on the shelf, since they do not have the appropriate base, equipment or trained personnel. The already mentioned Kaspmorneftegaz Association remains. But it is based in Baku, hundreds of kilometers away, which, of course, creates difficulties in the management of the brigades working on the offshore territory of the neighboring republic.

Kazakhstan can also make a much more significant contribution to the replenishment of the fuel balance of the country with reserves of natural gas. In the all-union balance of promising petroleum and gas sites our republic holds second place following the RSFSR. But the production volumes of "blue fire" here are considerable less than, say, in Turkmenia or Uzbekistan.

Meanwhile there are adequate data which attest that the depths of the republic hold large reserves of this valuable product. At the Kansu site, for example, gas gushers with a capacity of tens of thousands of cubic meters a day were obtained from two development wells. Commerical flows of gas have been obtained at the Alamurun, Yuzhnyy Zhetybay, Severnoye Rakushechnoye and other sights. There are cases which also confirm the great promise for gas of a number of offshore structures.

But here, too, we encounter the following situation. At none of the mentioned sites have the organizations of the republic Ministry of Geology and the Mangyshlakneft' Association completed the exploration and prospecting. On Mangyshlak Peninsula only one or two wells have been drilled in many structures. The prospecting of the promising sites of the Southern Ustyurt Plateau has not been carried out for a long time. It is clear that at this rate we will not soon be able to place the gas stores of Kazakhstan at the service of the country.

Many years of experience attest that the consistent increase of the reserves of natural gas is possible only by the forces of specialized subdivisions of the Ministry of the Gas Industry, which should elaborate locally the tactics and strategy of developing underground resources. Meanwhile, on all the territory of Kazakhstan there is not one organization of gas industry workers, which is dealing purposefully with the problems of exploring and prospecting for new deposits on dry land and at sea. It is difficult to call this situation normal.

It seems that for the purposes of the accelerated increase of the reserves of petroleum and gas in Kazakhstan the creation on Mangyshlak of an independent administration of offshore development drilling within the Kaspmorneftegaz Association would be advisable. Obviously, it is worth thinking about strengthening the scientific base--the organization of a branch of the All-Union Scientific Research Institute of Natural Gas in Alma-Ata. The thorough scientific substantiation of the exploration for new gas-bearing provinces, regions and structures could become one of the main directions in its work.

The prospecting and development of the natural resources of the Kazakh Shelf of the Caspian are an important reserve for the further reinforcement of the fuel and energy potential of the country. This problem merits, in our opinion, the serious attention of USSR Gosplan and more decisive actions of all the interested ministries and departments.

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FUELS AND RELATED EQUIPMENT

TURBINE EXPANSION ENGINE FOR GAS TRANSPORTATION

Moscow IZVESTIYA in Russian 7 Sep 79 p 1

[Article by V. Nat (Khar'kov): "Exactly According to Schedule"]

> [Text] The creation of the Soyuzturbogaz Scientific Production Association made it possible to shorten by several times the path from the development to the introduction of new equipment for the gas industry.

The production sections of the Krestishchenskiy gas field are spread out not far from the Moscow-Simferopol' Highway near Khar'kov. When speaking about it, specialists emphasize its youthfulness and, at the same time, its promise. Scientists and designers take a fancy to this field for testing highly efficient innovations under industrial conditions.

At present a new turbine expansion engine is being tested here. This compact automated unit is an important link in the preparation of gas for transportation. By means of it 5 million m^3 of blue fuel can be handled daily at a pressure of up to 100 atm. In the process of scrubbing impurities and valuable ingredients for obtaining benzine, kerosene and other chemical products are extracted from it.

"It works like a clock," the gas producers say of the turbine expansion engine. "It is possible only to thank the scientists for such reliable equipment, with which our field will be provided."

This praise pertains to the specialists of the Soyuzturbogaz All-Union Scientific Production Association, at which the first domestic turbine expansion engine of high productivity was developed. It was manufactured at the Uzhgorod Plant of Gas Transportation Turbine Plants, which belongs to the association. The entire cycle from designing of the unit to its delivery to the state commission was a little more than a year.

"It is possible to achieve a considerable increase of the efficiency of the gas industry only on the basis of its reequipment," relates Doctor of Technical Sciences A. Yazik, general director of the association. "And one of the most important problems is the improvement of the quality of gas preparation, which will ensure the reliability and effectiveness of operation of the gas transportation systems. The turbine expansion engine units, in contrast to the refrigeration machines now being produced for this purpose, will make it possible to ensure the required quality of gas preparation with the minimum of capital investments and operating costs. Moreover, considerably fewer workers are needed to built and operate the new plants. The extensive introduction of such units, especially at the deposits of the north, will save the national economy millions of rubles."

The association, which was set up only three years ago, is undertaking the solution of complicated technical problems. The installation of an experimental plant has begun at the testing ground of the association in Shebelinka. It should use the free heat of the exhaust of the compressor station for generating electric power.

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FUELS AND RELATED EQUIPMENT

NERYUNGRI COAL BASIN DEVELOPMENT

Moscow SEL'SKAYA ZHIZN' in Russian 26 Aug 79 p 1

/Article by L. Babin (Neryungri, Yakutskaya ASSR): "The Wealth of Neryungri"/

> /Text/ Coal holds an important place in the fuel and power balance of the country. At all stages of the history of the Soviet economy the Communist Party and the Soviet Government have devoted much attention to the development of the coal industry. New major mines and open pits have been built in three years of the 10th Five-Year Plan. The coal deposits in the eastern regions of the country are being worked especially intensively. The Communist Party and the Soviet Government are showing great concern about the multimillion army of miners of the country.
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> The miners are greeting their professional holiday with new labor feats in the fulfillment of the planning assignments of the fourth year of the five-year plan.
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> Today the newspaper tells about the business and people of the Neryungri Coal Basin.

Quite recently there was dense taiga here. Only the wind and wild animals disturbed the silence of the thick forests. But then a restless tribe of geologists came to these regions and discovered new wealth--copper, iron, mica, apatites, tens of other ores and minerals. The large coal reserves made Neryungri famous throughout the world.

"Here and there the seams come to the surface of the land and even break through the roots of old pines," claims one of the discoverers of the Neryungri Coal Basin, chief geologist of the Southern Yakut Combined Expedition and Hero of Socialist Labor S. S. Karimova.

For comparison it can be said that the Southern Yakut Coal Basin is much larger than the Kuzbass, which in coal reserves is equal to four Donbasses.

Now the capital of the Southern Yakut Coal Region--Neryungri--is being built here. Only five years ago about 300 residents were here, but on 6 November 1975 the settlement received the status of a city. Now its population has passed 50,000. Last year by the anniversary of Komsomol the first train proceeded ahead of time over the Small Baykal-Amur Main Rail Line from Tynda to Berkakit. Neryungri coal received an outlet to the "mainland."

The city is being built on permafrost, under inclement conditions. The coal mining facilities are being built at the same time as the construction of the city.

Here everything is impressive. The exactly vertical coal wall of the Neryungri open pit with the height of a 20-story building sparkles in the rays of the northern sun with a fantastic brilliance. You will not see such a brilliance anywhere. The powerful 20-ton rock excavators, which stand at the foot, seem like small insects, the mighty machines which bustle around seem like ants.

We are walking with Anatoliy Fedorovich Fogel', a driver of the technological transport garage. In spite of his Komsomol age, he is an old resident, one of the founders of Neryungri. And since the first days of work he has regularly overfulfilled the production assignments. Recently he received a 120-ton coal carrier.

"The truck works splendidly," Anatoliy says, "thanks to the Belorussian motor vehicle industry workers. Even more powerful equipment--180-ton dump trucks--is being used here in the stripping."

Many unique machines and devices are working in the open pit. And this is natural. For when the open pit reaches the planned capacity, 13 million tons of "black coal" will be mined here annually, or 600 large-capacity cars of coal a day.

The brigade leader of the multiple-skill brigade of installers, USSR Supreme Soviet Deputy Aleksey Borisovich Novolodskiy pointed out the concentration factory being built in Neryungri, the largest on earth. It will process 9 million tons of coal (the remaining 4 million tons will be used for power purposes for the GRES under construction), which will be transformed into 7 million tons of excellent coking concentrates. A 20-km railroad bed is being laid from Berkakit Station to the unique factory. Another station of the Small Baykal-Amur Main Rail Line--Ugol'naya--will soon appear here.

The construction workers are also concerned about the development of the agricultural base of the northern stoke hole. A livestock complex for 200 cows is being prepared to be turned over, the construction of a swinery for 500 head is being completed, 2,000 m^2 of film-covered hothouses are in operation. By next year the areas planted with vegetables, which are being cultivated in covered ground, will double.

Good relations have been established by the coal miners and construction workers with the workers of the Zolotinka Sovkhoz and other nearby farms. Here is what Petr Semenovich Fedorov, secretary of the Neryungri Gorkom of the Party, said about this:

"All our major enterprises have sponsorship agreements with the sovkhozes of the region and are constantly giving them material and technical assistance. Last year, for example, by the efforts of urban transportation we hauled more than 3,000 tons of mixed fodders. And now we plan to deliver no less to the farms. Cultural ties are also being strengthened. We frequently exchange concert programs, lecturers and so on. Jointly with the secretaries of the party organizations and the managers of the sovkhozes we have established prizes for production leaders and have introduced the honorary titles 'Best Milker' and 'Best Stock Breeder.'"

The Southern Yakut Territorial Production Association, which was specified by the decisions of the 25th CPSU Congress and is the first in the zone of the Baykal-Amur Main Rail Line, is being put into operation. The prophetic words of Lomonosov, that the wealth of Russia will be increased by Siberia, are coming true.

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FUELS AND RELATED EQUIPMENT

TRANSCONTINENTAL GAS PIPELINE

Moscow PRAVDA in Russian 5 Nov 79 p 1

/Article by B. L'vov, correspondent of the press center of the Ministry of Construction of Petroleum and Gas Industry Enterprises: "Ready for the Assault"/

> /Text/ Another, the 10th, landing force has landed at the route of the future Urengoy-Punga-the Polar Urals-Vutkyl-Gryazovets transcontinental gas pipeline. The most important construction project of the final year of the 10th Five-Year Plan has begun. The preparatory work on the route, which stretches over three time zones, is coming to an end.

On the new main line, as paradoxical as it may be, the crackling Siberia frost is the first helper of the construction workers. Their mechanized columns will be able to properly launch the work only after the cold has constructed ice bridges over the numerous swamps and marshes. There are more than 1,100 km of these sections on the route. That is more than half of the total length of the main line. And if you take into account that in the future it will stretch from Gryazovets to the Great Moscow Gas Loop, where it will be hooked up with the Central Gas Supply System, its length will approach 3,000 km.

But not only swamps and water-logged sections are hindering the construction workers. In order to open the way for the mechanized subdivisions, it is necessary to cut in the taiga a clearing with a total length of more than 2,050 km, to lay the thoroughfares near the route and to build helicopter pads. And, of course, before starting the main work on the route it is necessary to build tens of well-appointed field towns with an entire complex of modern municipal and general conveniences.

The first landing detachments, which are preparing the base, are engaged exactly in this. Here and there the welding has already begun. The subdivitions of the capital's Mosgazprovodstroy Trust and the welding and installation trust, as well as the Lengazspetsstroy Trust have already prepared hundreds of lengths of pipe for their welding into a solid thread. The Uralneftegazstroy Trust is also setting to work. The underwater constructions workers are leaving for the starting points. Ahead are 599 crossings over small rivers and 24 over major rivers.

But this is far from all the obstacles which the construction workers have to overcome. The blasters are preparing for the assault of the rocky spurs of the Polar Urals, the subdivisions of engineering preparation are preparing for the crossing of numerous highways, railroads and other artificial structures.

Taking into account the enormous importance of the fuel and energy artery being built for the increase of the production and transportation of gas from the regions of Western Siberia to the center of the country, the new main line has to be laid in practice in a year, much faster than the standard period. The collectives of the Main Administration for Construction of Pipelines in Siberia initiated the competition for the early fulfillment of the assignments according to the principle "A Workers' Relay Race." Having fulfilled on the eve of the 62d anniversary of Great October the plan of construction and installation work of the fourth year of the five-year plan, the Siberians put into operation almost 7,000 km of pipelines and tied into the gas and petroleum transportation systems 23 deposits of the Northern Ob' River region.

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ECONOMIC ASPECTS OF COAL INDUSTRY CONSIDERED

Moscow UGOL' in Russian No 7, Jul 79 pp 40-45

[Article by Prof A.M. Kurnosov, doctor of technical sciences, TsNIEIugol': "Problems of Economic Science in the Coal Industry"]

[Text] Advances and Difficulties of Production*

During the 60 years of Soviet rule our country's coal industry has had huge successes in its development. In a historically limited time (in less than 50 years) a highly mechanized and multi-sector industry with very large scales of production and capital construction was created practically anew and in strict correspondence with national economic plans; new coal basins were developed that are thousands of kilometers away from one another and from old regions with developed industry; hundreds of thousands of highly skilled workers and cadres of intellectuals with modern categories of specialists and organizers of production were trained and educated under the leadership of the Communist Party; a modern material-technical, planning and design, training and scientific-research base necessary for the sector was created, as was a structured system of management of a complex sector of the economy.

The development of the coal industry in the years of the 9th Five-Year Plan was marked with especially significant successes: extraction of coal rose from 624.1 million tons in 1970 to 701.3 million tons in 1975, and the proportion of the open pit method of mining increased from 26.7 to 32.2 percent; the number of coal mines was reduced from 642 to 538, and the number of operating working faces was reduced by approximately 1,000; the proportion of extraction from fully-mechanized faces at beds with an angle of incidence of up to 35 degrees rose to 60 percent, at cuts with the use of continuous operation technology it rose to 32.6 percent; the average monthly productivity of a worker's labor in mining increased by more than 28 percent, wages increased by 25 percent; 112.9 million tons of production capacities of coal mining enterprises was introduced.

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* Open to discussion. (Editors)

Along with this in the last years of the ninth and the first two years of the tenth five-year plans symptoms of a worsening of the conditions and indicators of work of the coal industry have appeared: there has been a reduction in the rates of growth of labor productivity of workers in extraction at the mines and open pits, and also a reduction in the loading on the operating working face at the mines, the quality of extracted coals has worsened, the average wholesale price of selling them has been reduced, there has been an increase in the prime cost of extraction at the mines and to a smaller degree at the open pits, and a further drop in profitability and increase in the number of mass work Sundays used by the mines for coal extraction have been observed.

The work indicators have worsened mainly in the case of the underground method of coal extraction, and this is explained by many factors.

In our opinion, the main reason for the strain in fulfillment of the plan assignments of recent years is that the intensive factors of growth in productivity still are not being used in due measure, while certain extensive factors have been disregarded prematurely. We will explain this using figures. The average daily load on a working face for the USSR Ministry of the Coal Industry and the Donets Basin rose respectively by 41.1 and 27.8 percent in 1970-1976, and the average daily advance of the working line of the faces during this same period increased for all mines of the USSR Ministry of the Coal Industry by 8.6 percent, and for mines of the Donets Basin by 2.1 percent. The growth in the average daily advancement of the working faces is the most graphic indicator of the complex influence of technical progress and the level of organization of production and labor. A change in the sector's average natural conditions of performing mining operations is reflected on this indicator to a significantly lesser degree.

If we are speaking about the specific influence of individual factors on the growth of the load per one working face for the USSR Ministry of the Coal Industry in 1976, only one-fourth (to be precise, 27 percent) of this increase was the result of an increase in the average daily advance of the working faces, about 28 percent was from the increase in the productivity (capacity) of the worked beds and about 46 percent was from an increase in the average length of the longwall. For the Donets Basin this relationship is even more not in favor of intensive factors of growth: obtained owing to advancement was about 10 percent of the increase, due to an increase in productivity of the bed more than 39 percent, and due to an increase in the length of the longwall more than 51 percent. It cannot be said that during this same period any kind of radical changes occurred in the quality structure and the quantitative parameters of mining operations of the coal mines.

The increase in the average length of the operating working face--from 117 to 137 meters (by 17 percent)--should be considered an important positive change in mining operations of the mines during the period under review. It is important also that, apparently, under the influence of means of overall mechanization of extraction the average capacity of the worked beds rose from 143 centimeters in 1970 to 159 centimeters in 1976 (by 11 percent). The range of drifts maintained at 1,000 tons of annual extraction rose during 1960-1970, but in 1970-1976 for the USSR Ministry of the Coal Industry it was reduced by 2.7 percent, and for mines of the Donets Basin it increased by 3.3 percent. The average speeds of performing all extractions of minerals not only did not increase during 1972-1977, but even dropped.

In 1976-1978 the situation was complicated because the growth in the average length of a working face for mines of the USSR Ministry of the Coal Industry and its two main basins--the Donets and Kuznetsk--ceased. At mines of the Karaganda basin the average length of a working face was reduced beginning with 1965, and at mines of the Pechora basin beginning with 1975. Moreover, it is necessary to consider that even according to their absolute value the average lengths of the longwalls and extraction zones in all the basins except for the Donets remain very small.

In connection with what has been said, the reduction in 1970-1976 of the specific volume of extractions per 1,000 tons of the total mining of coal by 22 percent for the USSR Ministry of the Coal Industry and by 20 percent for the Donets Basin should be considered excessive. In the Karaganda and Kuznetsk basins the reduction in the specific volume of performing preparatory driving continued in recent years as well. Many mines of the Karaganda and Donets basins are experiencing an acute shortage not only in the reserve but also in the operating line of working faces.

Studies made in 1975-1977 by the technico-economic analysis division of TsNIEIugol' [Central Scientific Research Institute of Economics of the Coal Industry] showed that the presence of a large number of mines which have not developed their production capacity (in 1976, more than 35 percent of the total number of administrative units) is explained first of all by the inadequate capacity of the front of excavations. Out of the 583 mines or technical units (comprising 82 percent of the total mine fund by number and 84 percent by capacity), the carrying capacities of the basic technological units of which were analyzed, the front of mining operations is the "bottleneck" for 54 percent.

It is evident from the figures cited that if we want to make the process of fulfilling the sector mining plan less strained and raise the yield capacity of the fixed productive capital of the coal mines, it is necessary to the highest degree to approach cautiously a reduction in the volume of preparatory operations and the excavation line of the faces at the mines, particularly at those mines where the front of mining operations is the "bottleneck" in the overall technological chain.

Among other reasons for the worsening of the sector's work indicators it is necessary to point out the slowing of the rates of scientific and technical progress in connection with the significant reduction in the field of possible application of already known means of mechanization of the basic technological processes and the absence of fundamentally new technical solutions for the vast area of conditions of underground mining of coal (steep beds, thin gently sloping beds, and also beds with very unstable lateral rocks, inclined to sudden outbursts, and so on); in connection with the absence or shortage of effective means of mechanization for reinforcement and repair of mine excavations, of flooring of the rail type, auxiliary transport, assembly and disassembly operations, equipment for cutting niches in the working faces, and so on; and in connection with the worsening of mining-geology characteristics, and also the brand and quality structure of coal deposits worked by the underground method.

Also exerting a negative influence are such "constantly operating" factors as: the presence in the work, along with excellent models of new equipment, of individual types of machinery and equipment with a level of quality (reliability, service life, suitability for repair), productivity or bearing capacity not corresponding to modern demands; the difficulties of supplying the sector with certain types of machinery, equipment, materials and spare parts; a level of organization of production and labor that does not correspond to the new conditions; a systematic lag in work to refurbish the obsolete mining faciliiies of a significant part of the mine fund; prevailing conditions of prices and costs for coal and machine building output that are disadvantageous for the coal industry; the great turnover of cadres in mine construction, coal machine building and many production associations for coal mining.

Under the established situation, life places serious tasks before mining economics which we will also attempt to set forth below taking into account the status and logic of development of the science itself and the specific features of its "language."

Economics of Investment Activity (Long-Range Planning, Designing and Capital Construction)

The effectiveness of investment and the basic activity of any sector of physical production is predetermined first of all by the making of a forecasting and then a long-range planning model of the development of the country's national economy as a whole. So far each mining sector, in building its own long-range plans, works with assigned ones, most often rigidly with specified addresses of the consumers and the sizes of their demands.

The demands for coal fuel are established on the basis of setting up the optimum fuel and power balance for the country, carried out by organizations of other ministries and departments with the participation of the USSR Ministry of the Coal Industry.

The effectiveness of any mining sector is predetermined by the effectiveness of the geological prospecting, by the economic quality of mineral reserves already prospected and planned for prospecting. Meant by the economic quality of a deposit is not only the physical size of the deposit and the consumption qualities of the mineral, the characteristics of the deposit by which the level of outlays for working it is determined, but also those economic-geographic factors which condition the total value of the outlays and the benefits from utilization of the reserves of a given deposit in the country's national economy.

In the field of geological prospecting, the most important scientific and technical problem, successful solution of which will predetermine the level of economic effectiveness of the investment cycle, consists in increasing the reliability of forecasting the physico-chemical and recovery properties of the mining mass. Large-scale miscalculations in the planning, construction and operating of a mining enterprise are inevitable without such a reliable forecast.

The next area of investment activity is compilation of a long-range plan of development of the sector. In a number of tasks here (preliminary placement of volumes of extraction of energy and coking coals in accordance with several preliminarily substantiated versions of the demand for these coals; compilation of a forecast of scientific and technical progress in the coal industry and in sectors using coal; working out variants of development of individual enterprises of the sector; compilation of a mathematical economic model of development and placement of the coal industry for the future; performance of optimization calculations on the model according to a selected criterion; analysis of optimization calculations and decision-making) there are many scientific economic problems on the successful solution of which the effectiveness of the chosen stragety for development of the sector is essentially dependent.

For brevity we will cite only a list of them: improvement of the methodology of development of the optimum fuel and power complex (TEK; toplivno-energeticheskiy komplex) for the country in the direction, in particular, of broader application of iteration procedures between the establishment of demands for individual types of energy resources on the basis of optimization of enlarged and aggregated models of a fuel and power complex for the country on the one hand, and establishment of more accuarate data on the cost of extraction, transportation and utilization of fuel on the basis of study of more detailed sector models, on the other;

improvement of the methodology of forecasting sector scientific-technical and socioeconomic progress in the direction of more complete accounting of objective laws of development of society, advances in the fundamental sciences, and the historical logic of development of the sectors of the national economy producing and consuming energy;

improvement of the optimizational apparatus of sector long-range planning, having the goal of solution of the following problems: determination of a rational level of aggregation of independent alternate models; reduction of the labor-intensiveness of preparing variants of values of independent variables and all the necessary initial information with development of a technology for the possibility of automatic generation of discrete or continuous values of these variables; consideration of the probability nature of data on the basic factors determining the economic results of the sector's activity; the transition from single-level to multi-level optimization (the lower level can be a basin or the region of a basin, the upper level can be the sector as a whole); study of the accuracy of making forecasts of conditions of production and substantiation of the reliability of decisions made on the basis of models of long-term planning.

According to the materials of long-term plans of development of the sector, which still are not an officially accepted stage of national economic planning, five-year plans of development of the sector are being compiled and approved, on the basis of which concrete decisions are being made about what to plan and build and where. Economic science must still work out and substantiate a system of relations between the long-range and the five-year, and also between the five-year and the annual plans. But one thing that is clear is that the degree of detailing of the plans of various levels of the time hierarchy, the character and degree of aggregation of the independent variables--of the optimized solutions, just as the nature of the limitations in the optimization models of these plans, cannot be identical.

Just as the apparatus of optimum planning serves (should serve) for the developers as a scientifically based tool of the plan of development for this or another unit of the national economy submitted for the approval of a higher level, so the apparatus of optimum planning of an individual enterprise serves as the most important tool, the means of economic substantiation of the chief decisions made in the planning of it by the developers. Complete analogy exists both in the goals and in the means of achievement of these goals between the divisions of science that are developing methods of optimum planning and optimum projection of national economic activity. This task is being solved with the use of methods of scientific and technical forecasting, mathematical economic models and electronic computers.

Practical, concrete planning, and the field of science called "optimum planning" have one common, extremely urgent problem, one of priority economic importance, of increasing the adequacy of the models or (as it is written most often, although it is not exactly the same in significance) of the reliability of planning decisions. It is necessary to increase the reliability of forecasting the natural, technical and socioeconomic conditions of performing mining work for 15-25 years into the future and more.

The specific problems strictly of optimum planning have been set forth previously in a number of works written by the author of this article or with his participation, and they remain unchanged over the course of many years.

Development of the methods and theory of optimum planning of mining enterprises requires the development of a large number of labor-intensive and cumbersome mathematical economic models and machine algorithms of their optimization, and the conduct of a large volume of experiments (calculations) on these models.

In the section of economic science dealing with the economics of capital construction, the main scientific and practical problem consists in working out ways and means of increasing the production capacities of the construction industry, the rates and quality of construction work, the validity of the plans, and improvement of the structure of management of construction industry organizations.

In the 10th Five-Year Plan after the transition of mine construction organizations to the jurisdiction of the USSR Ministry of the Coal Industry it was possible markedly to increase the introduction of capacities of coal-extracting enterprises. Nevertheless the demand for volumes of construction and reconstruction of coal extracting enterprises in some regions remains extremely high and it is not being satisfied not so much due to the shortage of capital investments as due to the shortage of construction capacities and the low rates of construction and installation operations. For many construction combines of the USSR Ministry of the Coal Industry and especially in the eastern regions of the country manpower is becoming the most critical resource.

Planning and Economic Incentive

The main practical and scientific problems of planning and economic incentive in the coal industry are: raising the validity of the plans and reducing to a minimum the number of enterprises, sections and shops not fulfilling these plans with respect to volume and quality indicators; developing such a system of indicators of evaluation of the production-economic activity and a system of material and moral incentive which would be a stimulus for worker collectives to make the maximum contribution to the socioeconomic progress of the sector as a whole by means of intensification of production, disclosure and utilization of all the reserves of its qualitative and quantitative growth with the most economical expenditure of the resources received from society.

Not all the goals mentioned above are attainable only through the means of planning and economic incentive. However it seems to us that the primary scientific and practical problem in this field is the development of methods for calculating the potentials of the production object (section, shop, enterprise) and its labor collective. In the absence of such reliable calculation methods it is impossible to speak seriously about the intensity and validity of the plan, about the size of the contribution of an individual labor collective to the national income, about the degree of utilization of the available reserves of production by this collective.

First of all, it is necessary constantly to improve the methods of calculation of the production capacities of coal-extracting enterprises and sections. The complexity of mining (with its basic work places and conditions that are continually shifting and changing in space and time) is so great, that we still are not in a position to forecast with sufficient accuracy the conditions of managing the industry, of insuring a stable course for it, of planning its potentially possible end results.

Second of all, it is necessary to work on creation of methods of calculation of "normative" technico-economic indicators (TEP; tekhniko-ekonomicheskiye pokazateli), based on the use of mathematical models of an operating coal extracting enterprise and electronic computers. By normative we mean those values of the technico-economic indicators which can be obtained by an enterprise using the production capacity and expending all types of resources (natural, physical, labor and monetary) in strict correspondence with the established progressive norms.

Third of all, it is necessary to learn to evaluate the effect not only of natural, and material-technical, but also of organizational and social factors on the quantitative and qualitative indicators of an enterprise.

The scientific problems that are next in significance with respect to the considered section of economic science are the development of methods of optimum current (monthly, quarterly and annual) and medium-term (five-year) planning and the creation of a system of scientifically based norms of all types of production resources. The traditional problem of underutilization of production capacities of the coal-extracting enterprises will be removed according to the degree of increase in the scientific validity of calculations of the production capacities of the mines and sections and the potentials of the labor collectives in the area of utilization of socio-economic and administrative levers, and also methods of optimum planning in the coal industry.

We will remark in passing that since the information utilized for calculation of the production capacity of a mining enterprise has limited accuracy (probabilistic character), the calculated value of the production capacity also has a limited accuracy and is a stochastic value. Therefore, if the planned release of output is equated to the production capacity of an enterprise (or even more so taken as higher than the production capacity), then the presence of a certain number of enterprises, the actual extraction of which exceeds their calculated capacity, and a certain number of enterprises not using their capacity is theoretically inevitable.

It is necessary to give a scientific basis for the coefficients of utilization of the production capacity of a coal mining enterprise and its individual technological units.

It is necessary to make up the existing "deficit" in the methods of complex planning of the social development of the sector. These methods should serve as the instrument for realization of the basic strategic tasks in the field of labor resources: the conduct of a labor-saving policy, stabilization and improvement of the cadre make-up, an increase in the prestige and productivity of miner's labor, improvement of the welfare of workers in the sector.

It is necessary to make the basis of the system of economic incentive for coal extracting enterprises an evaluation of the level of utilization of the production potentials of the labor collective, that is, of the level of utilization of production capacities and development of the potential values of the basic economic indicators: labor productivity, prime cost, and the prices of extracted coals.

The first possible means of solution of the difficult problems of material and economic incentive can consist in the broader conduct of well-conceived local socioeconomic experiments. A tested means is also the broad use of the advanced know-how of the production-economic activity of individual labor collectives. For instance, everyone knows the acuteness of the question of the shortage of "auxiliary" workers paid on a time-rate basis at the mines of the basins: the timbermen for repairs (besides those paid on a piece-rate basis), electrowelders, electric locomotive operators, and others. The use of bonus payments for this category of workers on the basis of standardized assignments in the Tulaugol' Production Association made it possible to reduce the labor-intensiveness of the jobs for this group of personnel, to improve the quality of repair operations, and to reduce the downtimes of equipment due to accidents with the mechanisms in the working faces (by more than one-third at some mines).

The general direction of improvement of the system of economic and particularly of material incentive should consists in the creation of greater interest on the part of the workers and engineering and technical personnel in revealing and utilizing production reserves. The differentiation in the payment for labor that is below average, average and highly productive should be more substantial. It is necessary to create the opportunity for an increase in the wage of an individual worker or collective in the course of a set period, if their labor provides, for instance, a result for the sector and for the national economy as a whole that exceeds these additional outlays several-fold.

In a period of complex mechanization of the basic operations at coal mines and pits the idea of introduction of aggregate norms is a very tempting one. At the basis of these norms should be a certain technical standard of the productivity of a group of equipment (whether it is in the longwall, bench or cutting face), determined based on a progressive technological scheme and organization of the performance of the operations.

And, finally, the system of awarding bonuses as a whole should be more simple and understandable owing to reduction of the number of indicators and the conditions for awarding bonuses and, possibly, more differentiated application of the scales of awarding bonuses to the specific conditions of labor. Taking into account that in recent years the gap in the wages for workers in the coal industry and other sectors of the national economy has been reduced, but the prestige of mining labor has dropped, it is necessary to solve the problem of organizing the scheduled wages of coal workers.

The few ideas we have expressed on the direction of improvement of the system of rate setting and labor remuneration are not claimed in any degree to be a complete and systematized list of measures for more rational utilization of this very important means of management. In-depth theoretical developments and well thought-out experiments are needed.

In recent years in the sector unfavorable conditions have taken shape for the conduct of production-economic activity on the basis of cost-accounting principles (self-support, profitability). The mining and geological conditions of extracting coal by the underground method are gradually worsening from one year to the next, but improvement of mining equipment and technology, or the introduction of new mines and layers are not in a position to compensate fully for the negative action of this factor. On the other hand, the rank and grade structure of the total extraction of coal is changing in the direction of reducing the actual wholesale price of a unit of coal output produced. The principles of cost-accounting management of the sector can be implemented only under the condition of bringing the price list for wholesale prices on coal into correspondence with the level of the socially necessary expenditures for its production (for this the prices should be raised not not less than 40-60 percent), and fulfillment of a complex of scientifically based engineering and organizational measures for stabilization, and at certain enterprises also reduction of the prime cost of production.

Organization of Production and Labor, and Management

The main practical tasks in this field consist in raising the level of use of calendar working time of people and equipment, reduction of down times and technological breaks, improvement in the quality of repair and operation of equipment, improvement in the general level of production and labor discipline, optimization of the use of manpower, and reduction of manual labor to a minimum.

Questions of organization of production are sometimes interpreted too broadly. Here it should be specified at once that not even the most ideal organization of production and labor can compensate for the damage caused as a result of making incorrect technical decisions (whether in the field of planning and realization of the plans for performing mining operations, or as a result of the use under given mining and geological conditions of the type and type-size of a group of equipment, to the technical characteristics of which these conditions do not correspond, and so on). The making of correct technical decisions is the prerogative of planning and designing mining production.

The birth of standards of scientific organization of production and labor on the basis of a creative merger of advanced production know-how and scientific and technical advances has become a true fact of science and practice with regard to the organization of production and labor in the limits of individual sections and work places. Serving as a striking illustration of this is the remarkable work of the brigades of working faces which when working sloping beds of primarily average capacity have attained an annual extraction of 0.5-1 million tons.

The task of science has consisted in the development of methods of analysis and generalization of the advanced production know-how of the "thousander" brigades, which has made it possible to disclose the basic "mainsprings" of the phenomenon of advanced know-how, to eliminate its individual negative features (if they exist), to enrich with elements of other advanced know-how and scientific-technical achievements from different information sources, to select the common thing from several advanced experiments that is suitable for broad application in a certain area of natural and technical conditions, and ultimately to compile the standards (model plans) of organization of production and labor for these conditions.

In the process of study and generalization of advanced know-how, we have obtained the first precious crumbs of knowledge about how individual material factors of labor (for instance, the speed and regime of operation of a stoping machine, the sequence and organization of execution of individual elements and operations of the technological cycle, the personnel composition of brigades and individual medical-biological characteristics of individual workers, and so on) affect the end result through the psychophysiological parameters of members of the labor collective. Even at the beginning of the route there are studies on ascertaining the effect of sociological characteristics on the results of labor. There is still much to be done to ascertain the role of sanitation and hygiene conditions of labor: temperature, dust content, humidity, element composition of the mine atmosphere, construction of the working space, lighting, noise and so on. The first methods for occupational sampling of the workers have been devised.

Just as a result of systems analysis and recording of the effect of the whole complex of natural, technological, technical, economic, organizational, sanitation and hygiene, medico-biological and sociological factors it is possible to work out a truly scientific organization of production and labor, to give an objective evaluation of the difficulty and other characteristics of labor, without which a scientifically based system for labor rate setting and remuneration cannot be created.

It is possible to say without exaggeration that even in the best brigades of the sector there are marked, and in the average and worse brigades--very significant reserves for improving the indicators of work, which can be used through the means of scientific rationalization of the organization of production and labor. The intrashift downtimes of working faces in many cases reach 30-50 percent, and technological interruptions reach 30-20 [sic] percent of the total length of the shift. A significant reduction in the downtimes and interruptions can be attained even with the present level of reliability of mining equipment.

Science still has to work out standards for scientific organization of production and labor in the limits of the whole production unit, and the more so of the production association. The criteria of referral to advanced production units and production associations have been worked out to a considerably lesser degree than for sections and brigades.

Already noted above was the necessity of development and constant improvement of the methods of calculating the production capacity of a coal-mining production unit and the normative values of its basic technico-economic indicators. According to the level of actual assimilation of these normative indicators it would be possible to judge what kind of enterprise operates better, what kind is worse, and where there is a higher level of organization of production and the labor of workers and engineering and technical personnel.

Development of mathematical economic models of operating production units and associations with the determination of normative values of tehhnico-economic indicators corresponding to the specific natural, technical, socioeconomic and organizational conditions is the way that is valid and reliable in a scientific respect, but it is very labor-consuming and requires highly skilled scientific personnel and considerable time for creation of a scientific project. There is another way that is less reliable, but easier. This is the way of empirical generalization of the advanced know-how of the work of enterprises. But here there is an incomparably more difficult task than the study and generalization of the advanced know-how of individual brigades and sections, since a production unit, and the more so a production association is a socioeconomic system of a completely different order of complexity. In order to solve this problem it is necessary first of all to standardize these production objects.

After the "beacons" are selected for each field of natural and technical conditions and the experience of their work is studied according to a scheme that is unified on the scale of the sector and carefully composed, just as in the case of dissemination of the advanced know-how of individual brigades and sections, it is necessary along with the traditional methods of scientific-technical and economic propaganda to resort to the compilation of an annual plan of dissemination of advanced know-how that is balanced with respect to resources. An apparatus for optimum annual and five-year planning would be extremely useful here.

It is possibleto mention as one of the basic directions which, in the author's opinion, it is necessary to follow in improving the organization of production and labor the strict, pedantic observance of production and technological discipline. This means namely the strict observance of technological schemes, the utilization of mining shifts for extraction of coal, and repair shifts only for repair, the strict observance of schedules for control inspections and planned-preventive repair of equipment, the use of Sunday work days only for repair of mining excavations and equipment, and the creation for labor collectives of more comfortable sanitary and hygiene conditions as much as possible and conditions that are stationary and rhythmical with respect to technological training and wages as far as possible.

We should not overestimate the role of individual modifications of the daily regimes of organization of the work of the breakage faces. Their strict observance and rational fulfillment is more important. It is important not only to allocate enough time for repair of equipment, but to use the time allocated daily and weekly for this purpose regularly and intensively, that is, with the necessary number of highly skilled mechanics.

The second direction should be careful study and creative comprehensive utilization of the advanced know-how of the work not only of the best brigades and sections, but also of the best production units and associations, not only of the workers but also of the engineering and technical personnel, not just the sector production know-how, but also information about scientific and technical achievements and advanced know-how of other sectors and other countries.

Deserving of especial attention is the study and propaganda of advanced methods of work of managerial personnel, and also of engineering and technical personnel, of the party and trade union organizations of production units and associations. It is necessary to bring to light and to realize those conditions of labor for managerial personnel which would contribute to full utilization of the creative capacities of the commanders of production, to reinforcing the prestige of the labor of mining specialists in general and of one who works creatively, with high efficiency in particular. A well thought-out system of training, advanced training, education and selection of workers and engineering and technical cadres will continue to play an increasingly important role. It is necessary more decisively to use the scientifically based recommendations regarding the occupational suitability of workers and managerial personnel.

In summing up what has been said, it follows to stress again that necessary in the established situation is a transition to a qualitatively new level of organization of production, labor and management, which will make it possible to attain a still greater upswing in labor productivity in all units of the multisector economy of the coal industry, and the formation and stabilization of new positive economic tendencies in the development of the sector. Of course this is not an easy task, it requires the full effort and close interaction of all the forces of the workers in science and production. There is not and cannot be any other intelligent alternative for a technical and managerial policy oriented to further growth in labor productivity under the conditions of the aggravated shortage of manpower.

Economics of Machine Building

Economic science must do what up to now it has done with insufficient results: on the basis of a general comparative analysis of the existing situation taking into account the tendencies of social and scientific and technical progress, make general recommendations concerning the necessary directions of development of the mechanization of operations in the coal industry and guiding economic estimates of its actual and planned effectiveness. We know from the experience of recent years how sometimes, without considering the economic consequences, a decision was made about the removal from production of one type or another of supposedly obsolescent equipment, but the series production of the new equipment was delayed and the fleet of operating "old" machines was not replenished and was not backed by the necessary quantity of spare parts.

With regard to the main and traditional task of the economics of machine building--determination of the level of quality of output produced, it should be resolved as a complex task of minimization of outlays for the production of coal output, including the production of mining machines and equipment, its operation, repair, assembly and disassembly, and also the production of spare parts and maximization of the result, expressed as the growth in the consumption qualities of coal output and the export potentials of the output of coal machine building.

As time goes on the successes of machine building, of the distribution and utilization of the on-hand fleet of machines will be determined to an even greater degree by the degree of exclusion of manual and heavy physical labor, the level of which in the coal mines, not only for auxiliary, but also for the most mechanized basic production processes, is intolerably high.

The problem of the economy of the quality of coal output was considered by us in one of the articles already published (UGOL', 1978, No 12, pp 38-41).

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COAL INDUSTRY PRODUCTION FIGURES GIVEN

Moscow UGOL' in Russian No 7, Jul 79 p 56

[Article: "In the Collegium of the USSR Ministry of the Coal Industry"]

[Text] The collegium of the USSR Ministry of the Coal Industry considered the question of the results of the work of the coal industry in the first quarter and April 1979 and measures for fulfillment and overfulfillment in 1979 of the plans and the socialist pledges made.

As a result of implementation of measures for translating into reality the decisions of the 25th CPSU Congress and subsequent plenums of the party central committee, and also the broad development of socialist competition for fulfillment and overfulfillment of the plan for 1979, in the first quarter definite successes were achieved in the sector. A number of measures was carried out aimed at additional introduction of working faces, particularly those equipped with mechanized complexes, an increase in the volumes of performing preliminary excavations, and staffing of coal enterprises with workers. As a result during January-April 1979 throughout the ministry the plan for coal extraction was fulfilled by 101.9 percent, and 4.5 million tons was extracted above the plan. By comparison with the corresponding period of 1978 the volume of extraction was increased by 1.2 percent.

The plan for extraction of coal by the underground method was overfulfilled by 4 million tons, and the plan for extraction by the open pit method was overfulfilled by 450,000 tons.

The plan for the volume of performing preparatory excavations was fulfilled, as a result of which the average operating line of working faces was increased by 11.3 kilometers, or 125 faces, in comparison with 1978.

An analysis of the results of the sector's work for the elapsed period of 1979 has shown that there were serious omissions in the work of individual associations. Certain production associations did not fulfill the plan for extraction of coal and owed more than 1,100,000 tons. Many associations did not manage to fulfill the plan for extraction in working days.

In a number of associations the volumes of making excavations continue to be reduced. Thus, in the Kuzbassugol' Association the reduction of this indicator against the corresponding period of 1978 came to 8.8 percent, for Prokop'yevskugol' it was 5.5 percent and for Chelyabinskugol' 12 percent.

The plan for stripping was fulfilled by 97.1 percent, which led to underfulfillment of the plan for prepared reserves by 2.1 million tons.

Individual associations are not doing enough work on improvement of the organization of jobs in the working faces and increasing the loads on them. Not enough attention is being given to guaranteeing the conditions for the work of highly productive brigades, as a result of which 23 brigades, struggling for achievement of a loading of not less than 500,000 tons per year, have not met their obligations, including 5 brigades of out 11 in the Vorkutaugol' Association, 4 out of 9 in the Gidrougol' Association, and 3 out of 7 in the Yuzhkuzbassugol' Association.

During 4 months of 1979 the machine building plants have not fulfilled the plan for production of mechanized timbering, extraction combines, scraper conveyers, mine cars, and the output of spare parts for mining equipment.

The Druzhkovka, Gorlovka and Anzhera machine building plants operated unsatisfactorily in the first quarter of 1979.

The plan for loading coal was underfulfilled by 12.4 million tons during the 4 months, mainly as a result of the unsatisfactory supply of railroad cars, and also the inadequate preparation of individual concentrating mills, the loading complexes of mines, pits and railroad transport facilities for work under winter conditions. Railroad cars were used especially unsatisfactorily in the Vorkutaugol' and Prokop'yevskugol' associations.

During the 4 months of 1979 the plan for capital investments was fulfilled by 90.2 percent, including that for construction and installation by 87.1 percent. For Soyuzshakhtostroy the plan for construction and installation was fulfilled by 81.8 percent. Up to the present time many underway construction projects have not been staffed with the necessary number of construction workers.

In order to fulfill and overfull the plan assignments and socialist pledges made in 1979 it is necessary to:

Analyze thoroughly the results of the economic activity of associations, enterprises and construction sites during January-April 1979 and, guided by the decisions of the April 1978 Plenum of the CPSU Central Committee, by the statements and conclusions contained in the speeches of the General Secretary of the CPSU Central Committee, Chairman of the Presidium of the

USSR Supreme Soviet, comrade L.I. Brezhnev at this Plenum and the first session of the 10th convocation of the USSR Supreme Soviet, to work out and implement the necessary measures for the fastest possible elimination of existing shortcomings in the work and for intensifying the regime of economy.

Implement measures for the fulfillment in the second, third and fourth quarters of 1979 of the underfulfillment of plan assignments committed in the first quarter and in April of this year with respect to the production of output, hauling of freight, and capital construction.

Implement measures for further development of the movement of collectives of "thousander" brigades. Especial attention should be directed to creation of conditions for the work of highly productive brigades, insuring fulfillment of the accepted obligations.

It is necessary to organize extensive study and dissemination of the know-how of the collectives of the mines imeni Kostenko, Nagornaya and imeni 50-letiya Oktyabrya regarding increasing the daily extraction and fuller utilization of mining equipment.

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FUELS AND RELATED EQUIPMENT

MINING ENGINEER A.V. DOKUKIN PROFILED

Moscow UGOL' in Russian No 7, Jul 79 p 60

[Article: "Aleksandr Viktorovich Dokukin: On His 70th Birthday"]

[Text] Aleksandr Viktorovich Dokukin celebrated his 70th birthday on 21 July 1979. He is a corresponding member of the USSR Academy of Sciences, professor, doctor of technical sciences, honored scientist and engineer of the RSFSR, and winner of the USSR State Prize.

All of A.V. Dokukin's scientific and engineering activity has been closely connected with the coal industry. In 1935 after completing the Moscow Mining Institute he was sent to the Kizelovskiy Basin, where he worked as chief mechanic of the mine and of the combine.

A.V. Dokukin's superior engineering and organizational abilities were manifested especially vividly in the period of his work in administrative positions in the coal industry: as chief mechanic of Glavugol' of the East, the People's Commissariat of the Coal Industy and the Ministry of the Coal Industry of Western Regions of the USSR. Created under his leadership was the sector's repair and machinery depot with mine-repair plants and central workshops. As chief mechanic and a member of the collegium of the Ministry of the Coal Industry of Western Regions of the USSR, A.V. Dokukin carried out restoration of the electromechanical equipment of mines in the Donets Basin.

A.V. Dokukin was the first director in the period of organization and establishment (1945-1947) of the Giprouglemash planning and design institute. He has always taken a strictly scientific approach to the solution of many complicated production problems. Thus, on the basis of analysis of the operation of compressor installations he published a number of articles and in 1944 defended a candidate dissertation and in 1949 a doctoral dissertation on the problem of controlling acid mine waters.

In 1950 A.V. Dokukin was appointed director of the All-Union Scientific Research Coal Institute (VUGI). Built in a relatively short period was the VUGI scientific-production complex, which grew into a large scientific research center with branches in the main coal basins of the country, which later became independent scientific research institutes.

In 1959, following the amalgamation of VUGI with the Institute of Mining of the USSR Academy of Sciences, A.V. Dokukin was appointed deputy director, and in 1962 he became director of the unified institute which was named the Institute of Mining (IGD) imeni A.A. Skochinskiy. Under his leadership the institute received further development and became the head institute in the coal industry. Solved with A.V. Dokukin's direct participation and leadership was a number of important scientific and technical problems of mining science with priority national economic significance.

A.V. Dokukin established a scientific school in the field of the dynamics and hydroelectric drive of mining machinery. He is the founder of a new scientific direction in mining mechanics--the static dynamics of mining machinery and pulse engineering. Under his leadership a theory of formation of loads in the elements of mining machinery was developed, and a complex of theoretical and experimental studies was performed for determination of the loading and dynamic characteristics of the drives of coal mining and tunnelling machines.

An outstanding direction in mining mechanics headed by A.V. Dokukin is the studies in the field of creating the hydraulic drive of mining machinery. Under his leadership theoretical and experimental studies were made to establish the optimum parameters and to create a method of calculating the centrifugal and positive-displacement hydraulic transmissions and high-torque hydraulic motors.

A.V. Kokukin published more than 300 scientific works, including 18 monographs which became widely known. He is also known as an outstanding inventor and creator of machinery and technological processes and has 95 author's certificates.

The name of A.V. Dokukin as an outstanding scientist and engineer is widely known by the scientific engineering community in the USSR and abroad. Over the course of many years he has conducted extensive and varied scientific-organizational and pedagogical work. He has trained 12 doctors and more than 40 candidates of technical sciences.

A.V. Dokukin befittingly represents Soviet mining science abroad, presenting scientific papers at world mining congresses, as well as papers and lectures at mining and polytechnical institutes in a number of foreign countries (People's Republic of Bulgaria, Polish People's Republic, Socialist Republic of Romania, Czechoslovak Socialist Republic, India, Peru, the United States, and the Federal Republic of Germany). In 1968 he was manager of the coal industry section of the Soviet pavilion at the World's Fair in Brussels, and in 1975 he was chairman of the scientific and technical center of the "Ugol'-75" International Exhibit of Mining Equipment in Donetsk. He has taken part in the expert review of large-scale projects in the USSR Gosplan Council for Scientific and Technical Expertise and in the development of long-range plans for development of scientific and technical progress in the coal industry.

A.V. Dokukin does a great deal of community work as a member of the editorial board of the magazine UGOL', chairman of the Moscow City Board of the Scientific and Technical Mining Society (NTGO), editor-in-chief of the abstracts journal GORNOYE DELO, and deputy chairman of the International Organizational Committee of World Mining Congresses.

A.V. Dokukin's extensive and many-sided activity in the development of Soviet mining science and technology has been valued highly by the Soviet government. He was awarded an Order of Lenin, five orders of the Labor Red Banner, the "Badge of Honor" order and many medals. Aleksandr Viktorovich is a full bearer of the distinguished "Miner's Glory" badge; he has been awarded the "Rebirth of Poland" order of the third class and the "Standard of Pracy" order of the first class by the Polish government; he was given the "Gold Medal of the People's Republic of Bulgaria for High Technical Progress," and he was elected an honorary doctor of the Silezskiy Polytechnic Institute of the Polish People's Republic.

The mining engineering community warmly congratulates Aleksandr Viktorovich on this glorious anniversary and wishes him good health and further successful scientific and community activity for the good of our homeland.

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